RAILWAY ENGINEERING
and Maintenance of Way

Published by the
BRUCE V. CRANDALL COMPANY, CHICAGO

BRUCE V. CRANDALL, President, CHARLES S. MYERS, Vice-President
O. W. BODLER, Secretary
O. H. REYNOLDS, Editor WARREN EDWARDS, Manager

Office of Publication, Rooms 409-410 Security Building, Corner Madison Street and Fifth Ave., Chicago
Telephone - - Main 3185.

Eastern Office: Room 714, 132 Nassau Street, New York City
Telephone - - 3524 John.

A Monthly Railway Journal

Devoted to the interests of railway engineering, maintenance of way, bridges and buildings.

Communications on any topic suitable to our columns are solicited.

Subscription price, $1.00 a year; to foreign countries, $1.50, free of postage. Single copies, 10 cents. Advertising rates given on application to the office, by mail or in person.

In remitting make all checks payable to the Bruce V. Crandall Company.

Papers should reach subscribers by the tenth of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.

Entered as Second-Class Matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

Vol. 1. CHICAGO, DECEMBER, 1905 No. 9

Evolution of the T-Rail

A STUDY of the history of the rail forming the tracks on our highways of commerce, shows one of the most interesting cases of evolution possible to conceive. First there were grooves cut in stone for the guidance of the wheels of the vehicle, after which came wooden stringers laid end to end on which the wheels rolled; this form of construction, however, proving too frail to withstand the load on the wheels, was improved by the laying of wrought iron strips on the top of the stringers, to which they were secured by spikes. This crude means of furnishing a pathway was quickly superseded by a rolled iron rail of T-section, and later by the steel rail familiar to all of the present generation. Further improvement was confined to weight of metal alone, the type remaining unchanged. The increase in weight has kept pace with the increase in weight of motive power and rolling stock, until now many roads that a few years ago had for a standard, rails of 56 pounds per yard, now use 100 lb. rails.

A New Theory of Crystalization

THE eminent scientist and engineer, Sir Purcell Taylor, has again been delving into nature's mysteries, and has brought to the surface some very interesting facts concerning the formation of crystals and the causes which produce them, also the probable existence of another state of matter beyond that of gas. The old theory of crystal formation in liquids presupposed absolute rest, but the recent researches of the authority named show that crystals are due to a rhythmic motion among the molecules of the material, and that they form alike in liquids, solids and gases from the same cause. It has long been known that vibratory action had the effect of producing crystallization in metals used in engineering, as in bridge members, locomotive details, etc., and there is no good reason to suppose that like causes should not produce like effects in other substances than metals, but we have become so strongly intrenched in some theories that are not so, that it will be some time before this discovery will be accepted as irrefutable.

Track Elevation Through Cities

THE work of track elevation above thoroughfares has assumed proportions little dreamed of when the city of Chicago inaugurated the extensive improvements which have solved one of the most serious difficulties involved in urban traffic. The millions of money necessary to accomplish this result have no doubt been parted with by the railways as a loss requiring years for them to recoup, but that view has been erroneous, as may be well understood by the increased volume of business made possible by an unobstructed roadway.

Work of this class is being extensively planned by several roads entering the city of Buffalo, where track elevation now contemplated will do away with twenty-seven crossings at grade; the railroad companies and city commission on crossings having so far cleared the situation as to agree on the proposition of elevation of the tracks. The proportion of expense by this agreement being 65 per cent. to the New York Central, which road will also meet the cost of maintenance, the city paying 35 per cent. It is understood that the above agreement is subject to approval by the other roads interested in the project.

At this time there is a job of track elevation in an advanced stage at Schenectady, where the New York Central has elevated its tracks over several streets, one of which is the principal business thoroughfare of the city. This work has been of an exceptionally peculiar character in providing for the skew bridge over the canal, immediately west of the station. Among the more recent improvements of this kind are the Pennsylvania tracks through Newark, N. J., and also the Delaware, Lackawanna & Western through the same city, the latter road having introduced a double-decked bridge in the course of the work, without impeding traffic; and the same road is now engaged in depressing its tracks to

pass under the Morris & Essex canal in furtherance of its scheme for improvement at Newark. All of these cases indicate the action of railways in thickly populated centers to not only safeguard human life, but also place their properties in the best possible condition to transact business.

The Technics of Ferro-Concrete

MNOAILLES in his paper before the Institution of Mechanical Engineers at the Liege meeting gave a summation of the technics of ferro-concrete in its application to various forms of structures, and went into the details of the design of members on the basis of present best information from test work combined with structures showing the latest results of theory and practice.

Among the interesting points elucidated was that of the effect of embedding metal in concrete, by which oxidization is arrested if already present, due to the chemical action of the cement. The treatment of the stress problem of the author was one of the clearest expositions of a difficult question, since the tests of steel and concrete beams have not in all cases given results identical with practical examples of work, and in the reference to stresses to be provided against—which involves the very life of the question of design—attention was called to those of a complex character which must be considered in connection with those of tension, shear and compression.

It was also shown that calculation is time wasted when great care is not taken to make the concrete elements in the beam of the best possible practice as to mixture and manipulation, and also showed that strain is first of all affected by the uncertainty regarding the law of deformation of concrete, particularly in compression. Of special interest was the proposition that shear when extending throughout the beam is equivalent to the binding movement of a uniformly distributed load, also the reversal of movements which produces deformation and stress opposite to those provided for by calculation. The light shed on reinforce concrete construction by recent investigation is well shown in the positive statement of Professor Rabut, who has given to the engineering world some exceedingly valuable information in this regard. Concerning the calculation of stresses in concrete structures he says: "I often hear it said that structures in ferro-concrete cannot be so accurately calculated as metallic structures. In my opinion, the contrary is true; the formulas for metallic bridges are in their principles just as arbitrary, and just as far from the expression of the real strains as those of ferro-concrete, but the latter have the advantage of containing twice as many constants—those of iron and those of concrete—which, if these constants are conveniently chosen, will allow of approaching the truth much more nearly." It would seem that there should be no difficulty in attaining some wonderful engineering achievements in the new form of construction if some of the difficulties heretofore encountered are as easily overcome as is implied in the above.

Problems in Sanitary Engineering

THE atmospheric conditions of the New York Subway has been a most prolific theme for complaint of those who by force of circumstances are obliged to make use of that artery of travel, they making the claim, justly, that the odors and temperature of the big bore are unbearable. Investigation of the causes and extent of the trouble was made at the instance of the Rapid Transit Board, by some eminent laboratory authorities who made a series of analyses of the air, and returned elaborate reports on the chemistry of it, which were highly satisfactory from a sanitary standpoint, but the odors and high temperatures continued to vex and make life unpleasant for the passenger. As stated in these columns, an attempt, partially successful, was made for improved ventilation by means of fans; that is, something of a circulation has been effected, whereas the air was stagnant before, but the high temperatures continue in the crowded cars.

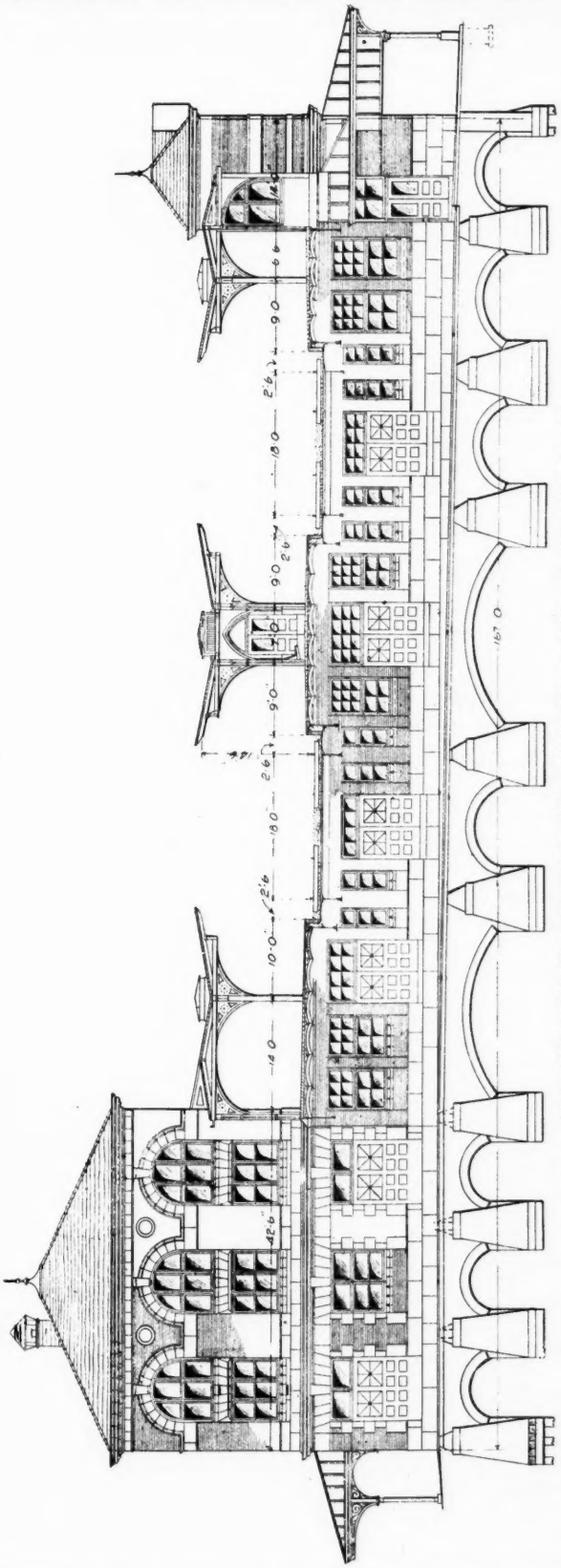
Another and equally serious complication has arisen since the Subway has gotten into active operation, namely, a dust resulting from the wear of brake-shoes which presents an atmospheric condition closely akin to that of the grinding shops in which metal was removed by the dry process. This phase of trouble was encountered by Mr. Geo. H. Soper, consulting sanitary engineer, in his investigations of the sanitary conditions of the Subway. In his report, he stated plainly that the results so far obtained give little cause for alarm concerning the sanitary condition of the air of the Subway. The principal objection is its high temperature.

The sanitary significance of the presence of black dust and bacteria which are contained in the Subway air still remain to be settled. The report took the ground that there is more fresh air in the Subway than is necessary to satisfy the demands and standards of the sanitary authorities, and there were less bacteria in the Subway than on the outside. The report attributes the constant odors to the newness of the work, and emanates from the paint, cement, lubricating oils, hot boxes and chemical deodorants, and in addition mentions the fact that stations should be cleaned and cared for in a more systematic and thorough manner.

The dust trouble is one that will offer fewer openings for adjustment than any of the others that have presented themselves, for the reason that it is accumulating with each stop or slow-down of a train, the brake-shoes charging the air with a dust which has 62.78 per cent. of iron by analysis. This is not surprising with a brake-shoe wear of one ton per mile per month, but the means for keeping such an element of danger out of the lungs will be likely to prove a problem that will tax the best talent that can be brought to bear on it.

There is one comforting thought for the engineers of the Subway, which, while it does not point to any expedient by which they may be able to better the present situation in all phases of the difficulties they are coping with, yet they can turn to the fact that the denizens of London are no better off in the avoidance of offensive

odors than are the people of New York. The City & South London tube and also the Central London underground road are just as rank offenders in that respect as our own, and this condition exists in the face of extensive schemes for ventilation by fans in the London bores, in which the attempt is made to exhaust the foul air from the ends, and induce fresh air to enter at the stations. The exhaust scheme works fairly well in New York, and may be considered to have solved the question, or at least to have blazed the way to a solution of it, but the impregnation of the air with iron particles is a menace to the health that will not be easy to down.



EAST ELEVATION NEW PENNSYLVANIA PASSENGER STATION AT WILMINGTON, DEL.

The New Pennsylvania Passenger Station at Wilmington

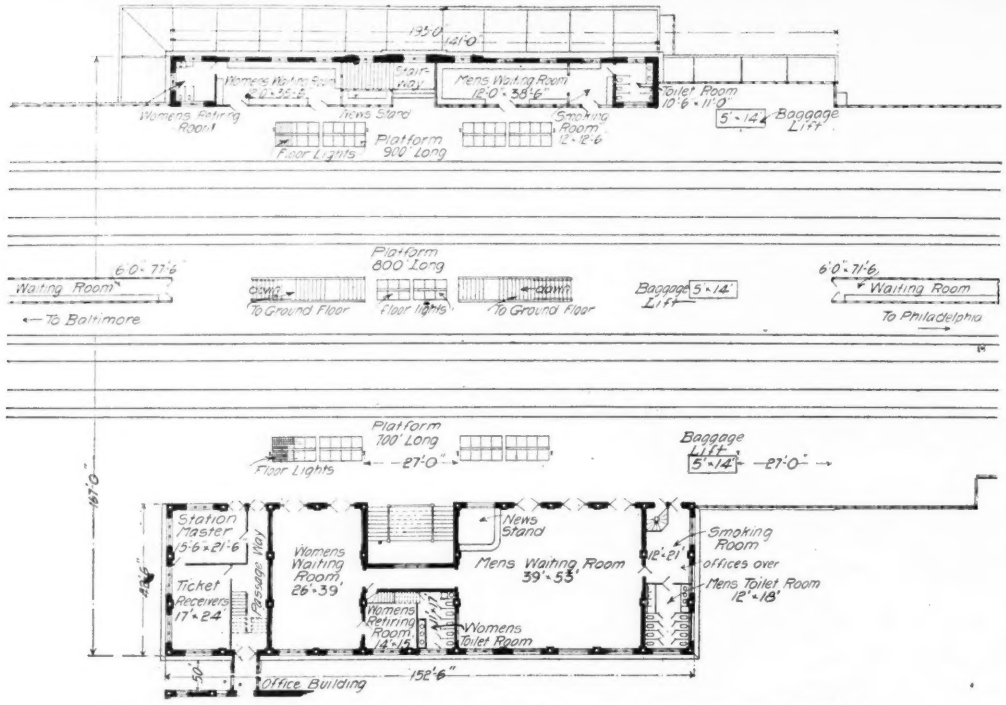
THE passenger station of the Philadelphia, Baltimore and Washington division of the Pennsylvania Railroad at Wilmington, is of more than ordinary interest from an architectural viewpoint as well as from that of advanced railway engineering, embodying as it does the most original thought in station design. The structure is an imposing one for division purposes, and in that respect marks a long step ahead in the matter of expense usually reserved for terminals alone.

The station is of stone below, while the upper part is of brick with terra cotta finish, the whole supported on arches which in turn are constructed on a system of grillage on piles. The piers are of concrete. Our illustration shows lines pleasing in their effects, to the extent that the strictly utilitarian idea does not predominate. A clock tower is at one corner of the front elevation, and the waiting rooms are at either side with access to both by passage ways from below leading to the train platforms between, up concrete steps covered by the Mason Safety Tread. In addition to the regular waiting rooms, there are auxiliary waiting rooms, 6 feet by 70 or more feet on the central platform for the protection of passengers from the elements.

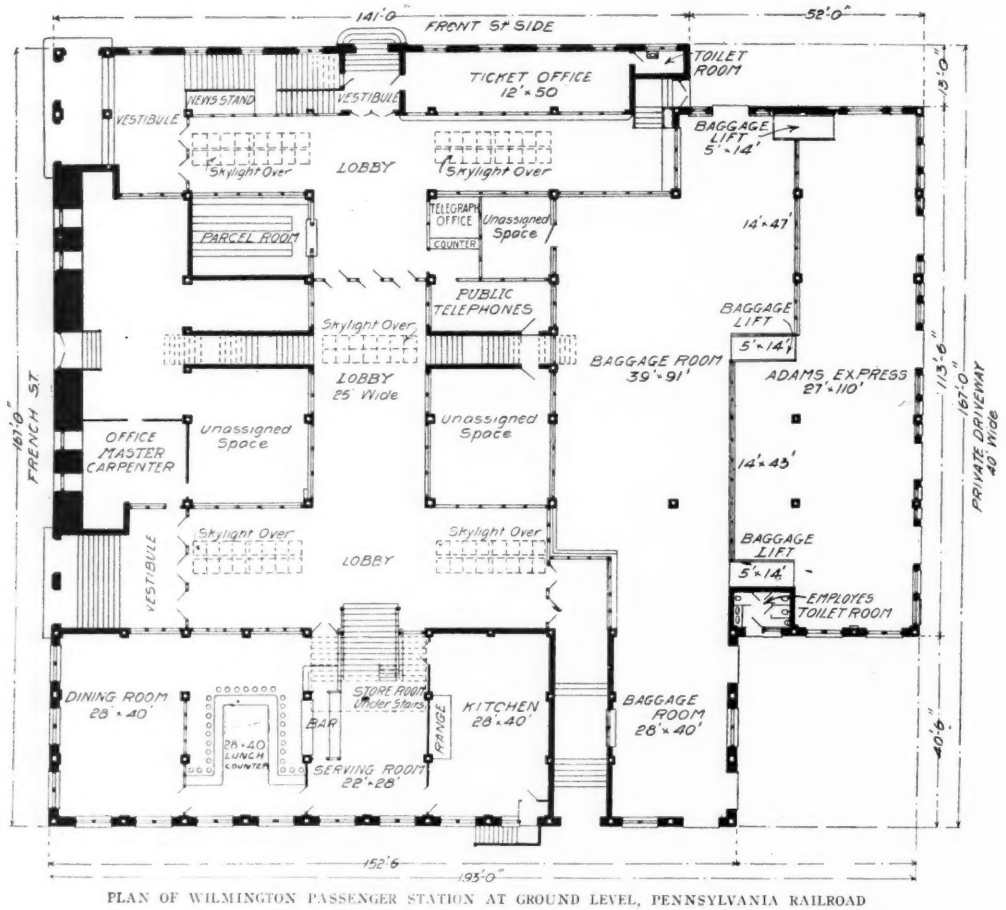
In accordance with the latest construction of station platforms, the continuous roof or train shed is an abandoned factor. The tracks are arranged in doubles leaving a central platform for trains in either direction.

The umbrella sheds which afford protection to the passengers, are supported on built up steel columns on which rest longitudinal girders of I section formed by riveting up angles to a central plateweb, these girders carrying transverse channels which support other longitudinal I girders on which the outer ends of the roof rafters rest the latter being of wood and enclined downward at the center thus diverting the drainage away from the trains. A lantern is placed above the roof at the center line, and is flashed with copper; the upper surface being covered with hammered glass; the roof boards are covered with slag. The struts from the platform posts, which are formed of two angles, are curved to give a gothic effect, while the central openings are filled with perforated plates, all of which lends an air of quiet finish in keeping with the whole scheme.

At the street approaches on two sides of the station there is a glass roof over the side walks, of the same general style of finish as the covering at the track level, but of a more eleborate character. The floors at the



PLAN OF WILMINGTON PASSENGER STATION AT TRACK LEVEL, PENNSYLVANIA RAILROAD



PLAN OF WILMINGTON PASSENGER STATION AT GROUND LEVEL, PENNSYLVANIA RAILROAD

ground will be of cement upon a cinder foundation, and concrete will also be used for floors carried on beams or arches. The platforms and sidewalks and also some of the floors, will be of Granolithic finish, which is to be used as well for a floor foundation in the toilet rooms. The style of floor is hollow terra-cotta of

the arched tile form. The partitions will have expanded metal lathing, on which will be placed three coats of plaster hard finished. The interior woodwork finish will be in general of white oak, in all public rooms. The stairways are of metal in all cases, and with bronze finished railings, in the important locations. The stair treads are finished in several styles, as marble, the Mason Safety tread, as stated, and with rubber tile laid in cement. The roofs are to be covered with tile secured with copper nails, while the ridge mouldings are to be covered with terra cotta.

All flashings, cornices, gutters and valleys, and also the finals and weather-vanes will be of copper.

By the terms of the brief description of this station, which is to be one of the best examples of its kind, it is seen that the builders have omitted nothing to bring it up to date. This work, though, is simply an incident in the immense improvements being prosecuted by the Pennsylvania road at Wilmington, among which are a new office building, also nearing completion; immense retaining walls at the crossing of the P. R. R. and B. & O., and a brick arch viaduct, all of which are based on modern engineering. We are indebted to Chief Engineer Wm. H. Brown for prints from which our illustrations are made.

British Standard Specifications for Cement *

A COMPARISON of the American standard specifications for Portland cement and those adopted in December, 1904, by the Engineering Standard Committee of Great Britain is very interesting. On the first item of the definition of Portland cement, the British specification suggested water and sulphate of lime as materials which may be added to retard the setting, and covers both in the specification, limiting the amount in either case to two per cent. In the American specification, any addition subsequent to calcination is limited to three per cent. On specific gravity, both the specifications practically agree to 3.10, but the British specification raises the amount to 3.15 where the cement is sent directly from the mill to the laboratory in tightly sealed cans. On fineness, there is a material difference in the screens used, and it may be stated that the American specification which has eight per cent. on a No. 100 (10,000 mesh) seive, and 25 per cent. on a No. 200 (40,000 mesh) sieve would require a finer grinding than the British, which has three per cent. on a 5,776-mesh sieve, or 22.5 per cent. on a 32,400-mesh sieve.

A variance is seen in the matter of setting. Our specifications require that the cement shall develop intial set in not less than thirty minutes, and develop hard set in not less than one hour, nor more than ten hours. The British specification recommends three distinct grades of time for setting, which are designated as quick, medium and slow. The first is not less than ten minutes nor more than thirty minutes; the second is not less than thirty minutes or more than two hours, and the third is not less than two hours or more than five hours, and yet while these grades of time of setting are recognized, and each of them will have a material bearing upon the tensile strength of cement, the British specification in the matter of tensile strength has but one series of limits, namely:

SEVEN DAYS.

Neat	400 Lbs.
3 sand, 1 cement	120 Lbs.

TWENTY-EIGHT DAYS.

Neat	500 Lbs.
3 sand, 1 cement	225 Lbs.

The American specification, on the other hand, while not recognizing different classes of cement, so far as the time of setting is concerned, does recognize different strengths in tension, and has what the British specification has not, a twenty-four hour test which may possibly in some quarters be considered superfluous for Portland cement. The American requirements are:

SEVEN DAYS.

Neat	450 to 500 Lbs.
3 sand, 1 cement	150 to 200 Lbs.

TWENTY-EIGHT DAYS.

Neat	550 to 650 Lbs.
3 sand, 1 cement	200 to 300 Lbs.

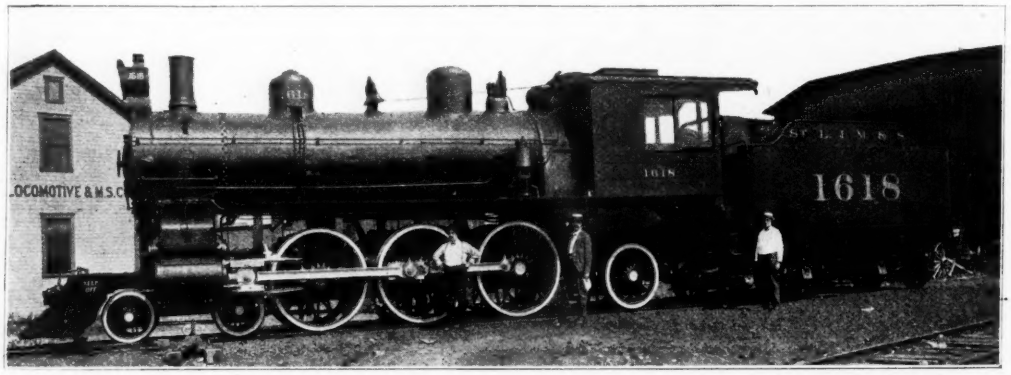
and are all higher than those of the British specification, which is no doubt due to the fact that there is more rotary cement manufactured in our country than possibly anywhere else in the world. More interesting, however, is the difference in the matter of gain in strength at longer periods, a new requirement which has only come into cement testing since the introduction of the Rapid Transit specification in New York. In the United States, in view of the fact that the matter has not been thoroughly settled, we recognize broadly that no cement shall show retrogression. In the British specification, however, this question of the increase of strength between the seven-day and 28-day periods is graded according to the initial strength shown by the cement at the seven-day period, which seems to be a fair method of determining increased strength between the periods stated. In their specification a cement showing 400 to 450 lbs. at seven days is to gain 25 per cent. in 28 days; 450 to 500 lbs., 20 per cent.; 500 to 550 lbs., 15 per cent., and all over 550 lbs., at seven days, an increase of 10 per cent. in 28 days. This is a very fair view of the subject, as a cement that pulls 600 to 800 lbs. at seven days will have to increase very many pounds in tension to acquire the strength to show 25 per cent. increase between the seven-day and 28-day periods, while a 10 per cent. increase would be a much more reasonable figure.

The great and salient difference between the two specifications is that governing the test for constancy of volume, or what are known technically as accelerated tests. In our specification we have adopted the hot and cold water tests prescribed under the German normal test, and which have been in use so successfully for so many

*Excerpts from a paper read by Robert W. Lesley, vice-president of the American Society for Testing Materials, before that society.

years, and have supplemented them by a steam test after the cement is set for 24 hours, consisting in exposing the pat in an open vessel, to steam rising from a body of water beneath. The British have adopted what is known as the Le Chatelier test, which is fully described in the specification, and which so far has not been generally adopted outside of France. This is the part of the specification which up to date has attracted most criticism by reason of possible inexperienced operators not producing similar results, with similar cements under similar circumstances.

The chemical requirements of the cement differ in the two specifications as follows: In the American specification 1.75 per cent. of anhydride sulphuric acid is permissible, while in the British specification the limit is run up to 2.5. In England 3 per cent. of magnesia is allowed as against 4 per cent. in America. Insoluble residue in England is limited to 1.5 per cent., for reasons that may not be necessary in this country.



130 TON LOCOMOTIVE REBUILT BY THE EAST ST. LOUIS LOCOMOTIVE AND MACHINE SHOP CO.

Big Locomotive Overhauled by East St. Louis Locomotive & Machine Co.

THE East St. Louis Locomotive & Machine Shop Co., located at East St. Louis, Ill., have recently rebuilt and turned out for the St. Louis, Iron Mountain & Southern Railroad one of the largest locomotives running west of the Mississippi. This engine was given a most thorough overhauling, and was turned out as good as new. Included in its rebuilding was an entirely new fire-box, which was very large, requiring 2,500 stay-bolts to hold it in place; also the taking out of both of the old cylinders and replacing them with new ones; the taking out and repairing of the flues, 260 in number; the turning down of the tires on the six driving wheels and trailer, and a general overhauling of the machinery. This locomotive has six 5 foot 10 inch drivers, two 4-foot trailers and a four-wheel truck in front. From the top of the rail to the top of the boiler is measured 12 feet; total length of engine and tank, 65 feet, the tank holding 5,000 gallons of water and 10 tons of coal. Total weight of engine and tank, ready for service, 130 tons.

They have also just turned out for the same road a 90-ton freight engine, with eight drivers; and are now working on several others for the Missouri Pacific railroad. Also the following additional locomotives for the parties named: A 90-ton engine with six drivers for the St. Louis & O'Fallon railroad; a 40-ton saddle-tank six-driver engine for the Fairview Transportation Co. of Golconda, Ill.; a rebuilt Baldwin Mogul of 38 tons for the Angelina & Neches River railroad, a logging line of the Angelina County Lumber Co., of Keltys, Tex.; also two locomotives of the same type sold to the Stout-Greer Lumber Co., at Thornton, Ark. They also sold a 40-ton Mogul to the Summit Lumber Co., of Randolph, La., and a narrow-guage to a Texas firm, besides leasing one to the J. A. Ware Construction Co.

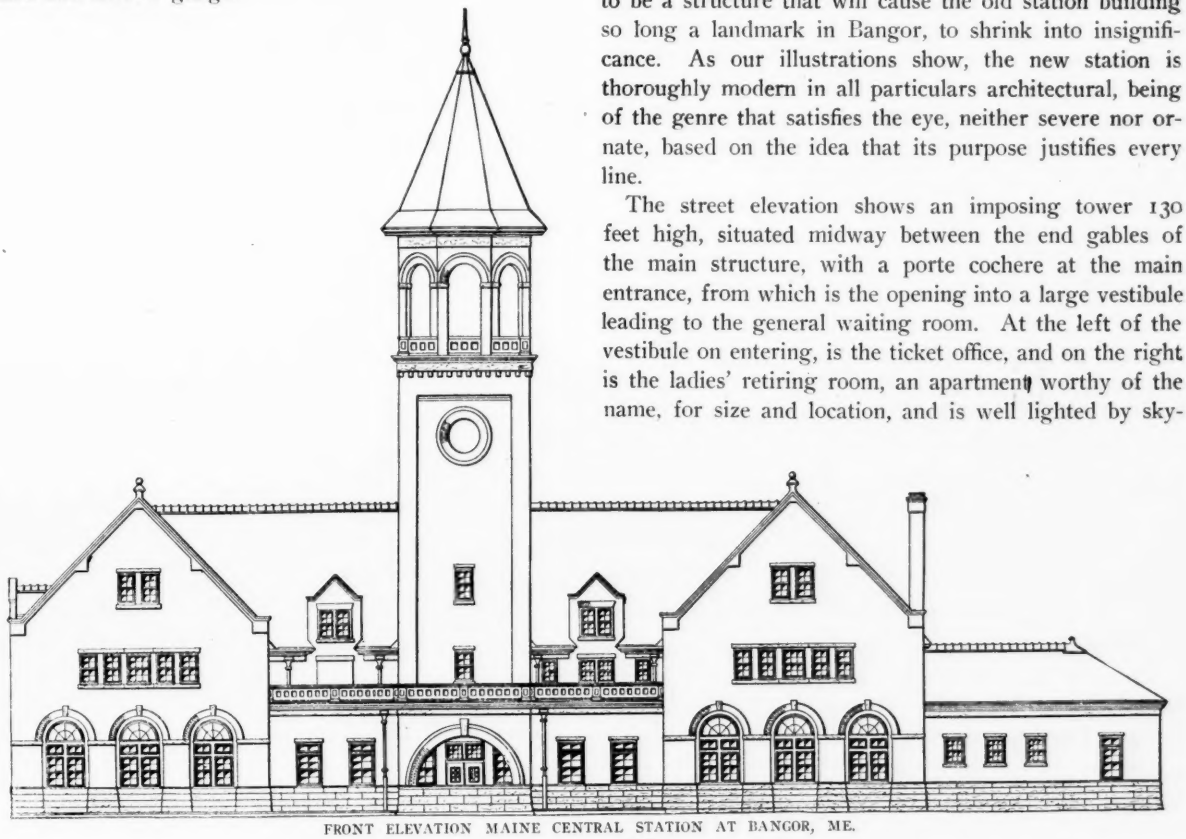
130 TON LOCOMOTIVE REBUILT BY THE EAST ST. LOUIS LOCOMOTIVE AND MACHINE SHOP CO.

The company's shops have until recently been running both day and night crews on hurry orders, and they are still well filled with work, and have work ahead to keep them busy for several months to come; outside work, as well as refitting engines of their own for sale, both standard and narrow guage.

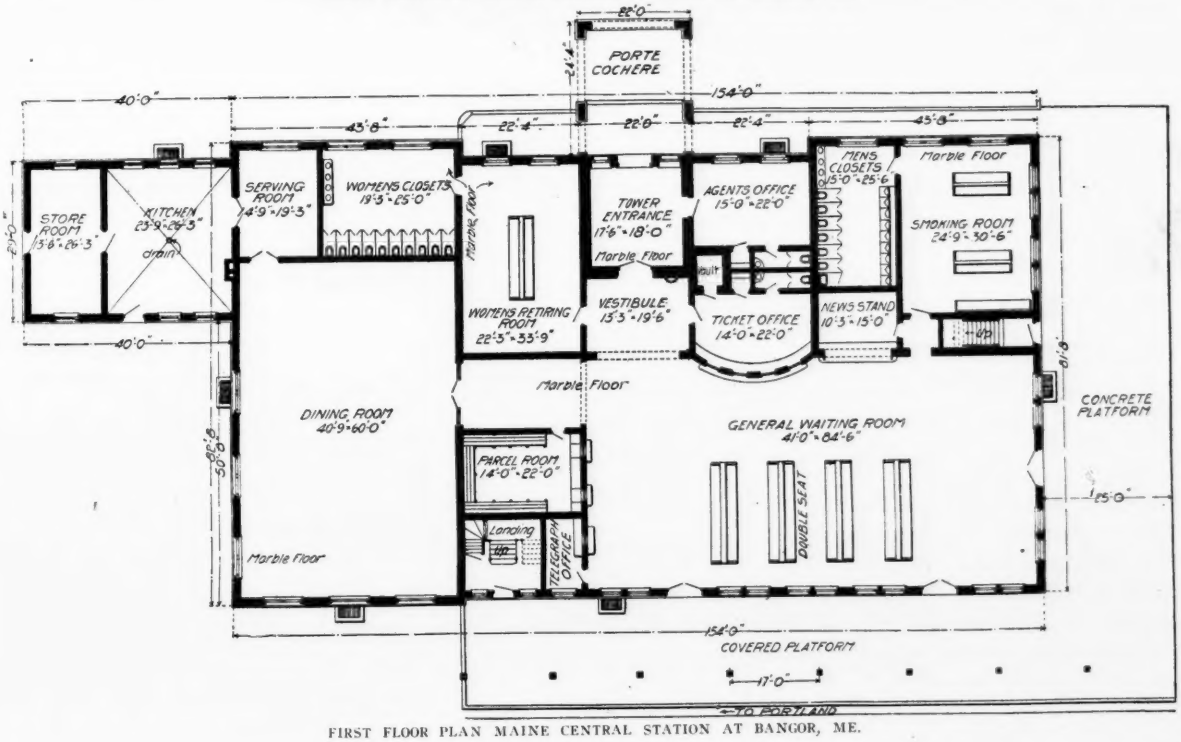
Maine Central R. R. Passenger Station, Bangor, Maine

THE new passenger station of the Maine Central at Bangor, Maine, now in course of construction, and to be completed early in the summer of 1906, is to be a structure that will cause the old station building so long a landmark in Bangor, to shrink into insignificance. As our illustrations show, the new station is thoroughly modern in all particulars architectural, being of the genre that satisfies the eye, neither severe nor ornate, based on the idea that its purpose justifies every line.

The street elevation shows an imposing tower 130 feet high, situated midway between the end gables of the main structure, with a porte cochere at the main entrance, from which is the opening into a large vestibule leading to the general waiting room. At the left of the vestibule on entering, is the ticket office, and on the right is the ladies' retiring room, an apartment worthy of the name, for size and location, and is well lighted by sky-



FRONT ELEVATION MAINE CENTRAL STATION AT BANGOR, ME.



FIRST FLOOR PLAN MAINE CENTRAL STATION AT BANGOR, ME.

lights as well as windows. The general waiting room is 41 feet 10 inches wide by 84 feet 6 inches long, and lighted by fourteen windows on the platform sides which open to the trains. The platforms are of concrete, 25 feet wide, and that parallel to the tracks is covered. The dining-room is also of ample proportions, and is reached by a corridor from the waiting room, as is also the smoking room. The toilet facilities are very liberal and of the most modern type. Provision has been made for official accommodations on the floors above.

In material and finish the building will be, for the exterior walls, of buff brick with brownstone trimmings. The interior walls of the first story will be of buff brick, except in the smoking room, which will be of white enameled brick to a height of 10 feet 6 inches; and the men's and women's closets, which will be of white enameled brick to the full height. The dining-room will have a wainscot of light green enameled brick to a height of five feet. All wood finish on the first floor is to be of quartered oak, while that above in the offices will be of cypress. The roof will be covered with red slate and have terra cotta at all ridges. Steam and electricity will furnish heat and light in the whole structure. All flooring will be of marble except that in the serving room and kitchen, which will be of asbestolith.

For the prints illustrating this station, and for the more important data presented, we acknowledge the courtesy of Chief Engineer Theo. L. Dunn.

Tie Preservation of the A. T. & S. F. Ry.

THE Santa Fe has used the zinc-chloride process of treating their ties for the past twenty years, changing to the Willhouse modification, known as the zinc-tannin treatment, twice during that time.

The tabulations shown herewith show the number of ties renewed on certain divisions of the road during the first half of the present year. This shows that the Eastern Grand division has placed about 708,000 treated ties in the track. There is an excess of insertions over removals due to the fact that on the Illinois, Missouri and Eastern divisions some new second track was laid. On the Kansas City division some new tracks were laid in the Argentine yard, and on the Southern Kansas division there was an extension in which treated ties were laid.

On the Western Grand division about 337,000 treated ties were laid. This division also shows an excess in inserted over removals on account of the new work, and also to some extent on account of closer spacing. On the Rio Grande division a number of treated ties were laid where the track had been destroyed in washouts.

The zinc-chloride treatment plant at Somerville, Tex., will be abandoned about the end of the year, when a new plant will be ready for operation. A new plant is being constructed at Somerville for the application of the Rueping process. The Reuping process is a modified creosote treatment which the A., T. & S. F. has decided to adopt.

Ties Inserted

	Treated	Not Treated	Total
Western Division	111.090	1095	112.185
Panhandle "	95197		95197
Colorado "	32958		32958
New Mexico "	45.386	44 312	89 698
Rio Grande "	52983	394	53 377
Total	337.614	45 801	383 415

THE ATCHISON, TOPEKA & SANTA FE RY. (WESTERN GRAND DIVISION)
Statement of Ties Taken out and of Insertions, 1st half of 1905

Year Treated	Western Division Taken out Treated Rotten	other Causes	Total	Not Treated Rotten	other Causes	Total	Total Taken out	Panhandle Division Taken out Treated Rotten	other Causes	Total	Not Treated Rotten	other Causes	Total	Total Taken out	Colorado Division Taken out Treated Rotten	other Causes	Total	Not Treated Rotten	other Causes	Total	Total Taken out	New Mexico Division Taken out Treated Rotten	other Causes	Total	Not Treated Rotten	other Causes	Total	Total Taken out	Rio Grande Division Taken out Treated Rotten	other Causes	Total	Not Treated Rotten	other Causes	Total	Total Taken out
1885	5		5																			242		242					2584		2584				
1886	47		47																			382		382					1478		1478				
1887	139		139																			480	14	494					4345		4345				
1888	166		166								121		121									856	18	874					5883		5883				
1889	757		757								11		11									1204	5	1209					1035		1035				
1890	75		75								18		18									1469	2	1471					868	61	949				
1891	77		77								109		109									1990	12	2002					1552		1552				
1892	338		338								476	3	479									3791	72	3863					3721	101	5822				
1893	1414	13	1427								1011		1011									3945	58	3993					2197		2197				
1894	2123		2123								2453		2453									3692	39	3731					2815		2815				
1895	2343	40	2383								1608	8	1616									3523	68	3591					2323		2323				
1896	3507	40	3547								2008	8	2016									5530	31	5571					1374		1374				
1897	218	2	220								707	20	727									3604	126	3730					271		271				
1898	333	47	380								214	11	225									4316	226	4542					152		152				
1899	250	62	312								28	10	38									3269	317	3586					242		242				
1900	274	28	302								3		3									427	101	528					58		58				
1901	311	47	358								8		8									495	323	818					16	32	48				
1902	2	15	17								41		41									61	295	356						25	25				
1903		19	19								2	13	15									10	103	113						48	48				
1904		61	61																				71	71											
1905 Mar. & Apr.			215																				92	92											
Total	12716	374	13090	18497	1748	12945	25935	5205	347	5552	8589	1076	9665	15217	64	66	130	1815	504	1839	2740	68083	2156	70239	4400	866	5266	32606	6722	470	7192	8922	811	9733	44085
Average Life	10.9 Years			Not known				6.7 Years			Not known				10.9 Years			Not known				10.9 Years			Not known				15 Years			Not known			

THE ATCHISON TOPEKA & SANTA FE R'Y. (EASTERN GRAND DIVISION)
Statement of ties taken out and of insertions. 1st half of 1905.

Year Treated	Illinois Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Missouri Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Kansas City Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Eastern Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Middle Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Southern Kansas Division: Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out	Oklahoma Division (including Eastern Oklahoma Railway): Taken out — Treated: Rotten	Treated: other causes	Treated: Total	Not treated: Rotten	Not treated: other causes	Not treated: Total	Total Taken out
1896																																															
1897																																															
1898																																															
1899											327		327																																			
1900	695										39		39									323	13	336																								
1901	73	9	22								129		129									411	265	676																								
1902	40		40								18		18									8	30	38																								
1903	10		10																			1	67	68																								
1904																							123	123																								
1905																							3	3																								
Mar. 31																						4	28	32																								
Total	748	19	767	58	180	238	1005	1	314	315	1	200	201	516	1	314	315	1	904	905	1220	830	361	1191	2	2397	2399	3590	117	209	326	1	902	903	1229	6	174	180	1	902	903	1083	35	1538	1573	2656
1906	3½ Years			Not known				5 Years			Not known				5.9 Years			Not known				5.9 Years			Not known				6.8 Years			Not known				6.2 Years			Not known				7.2 Years			Not known			

Ties Inserted.

	Treated	Not treated	Total
Illinois Division	111.894	111	112.005
Missouri "	72.048	1.605	73.653
Kansas City "	29.094		29.094
Eastern "	110.002	850	110.852
Middle "	124.041	219	124.260
Southern Kansas "	190.219		190.219
Oklahoma Division	70.891		70.891
Total	708.88	2.765	710.455

We are indebted to Mr. E. O. Faulkner, manager of the tie and timber department, for the above tables.

The New York Subway Signal Record

THE report of signal failures and delays to traffic in consequence, month of September, for the in the New York Subway, is presented in the following tabulated statement, in which it will be seen that in no case was the signal mechanism at fault. This is a most flattering testimonial to the efficiency of the system installed, since the failures to the number of movements are so far below average performance. One cause of this remarkable showing is of course the exceptionally good conditions, which do not exist in surface signalling.

A study of the table will reveal the character of the failures and the number of delays; the record is no doubt without a parallel when the movements are taken into account. This system, it will be remembered, was a special development to fit conditions having nothing in common with surface signalling, and was worked out on original lines best suited to the requirements of the case.

	Causes of Failures.	Sections. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Failures.	Delays.
Signals.	A. C. Relay																		
	Broken wire																		
	Broken track wire																		
	Burned pipe																		
	Broken grid																		
	Careless repairmen																		
	Fuse												3					3	1
	Frozen valve																		
	Insulated joint				2							1	1					3	5
	Loose wire																		
	Low A. C.																		
	Low D. C.																		
	Low air pressure																		
	Lights out																		
	Lack of oil																		
	Transformer short circuit primary												1					1	2
	Train ran by signal																		
	11,000 V. main burned																		
	Unknown																	4	
	Leaky valves																		
	Poor spring contact on machine			1														1	1
	Poor spring contact on home signal												1					1	
	Total signal failures and delays																	9	9
Automatic Stops.	16-Car Relay																		
	Broken wire		1															1	2
	Frozen valve																		
	Loose wire																		
	Low air pressure																		
	Lack of oil																		
	Mechanical trouble																		
	Stones																		
	Shifting ties			1														1	1
	Unknown																		
	Leaky valves																		
	Total automatic stop failures and delays																	2	3
Switches.	Broken cylinders																		
	Broken wire																		
	Bad points																		
	Frozen valves																		
	Loose wire																		
	Low air pressure																		
	Lack of oil																		
	Obstruction in points																		
	Out of adjustment																		
	Switch run through						1							2				3	4
	Indication spring																		
	Water in substation						1											1	2
	Total switch failures and delays																	4	6
	Grand total signal, stop and switch failures and delays																	15	18

General Remarks—Total failures of signals and stops for the month of September were 11, or one failure to 464,694 movements; 3 of the 11 failures were caused by water leaking through the roof of Central Park Tunnel, blowing fuses at signals. Thirty-six interlocking plants in service during the month. Only one failure can be charged against these, and that was caused by water getting in the air intake pipe of the air compressor at substation No. 14.

Track Surface and Lines *

IT is hard to imagine a mechanical appliance more crude and at once more economical than the modern railroad track. Two parallel bars of steel fastened upon blocks of wood, which are in turn imbedded in loosely broken stone, possibly gravel, often Mother Earth. The improvement of the locomotive's highway has certainly failed to keep pace with the rapid advance of the locomotive itself. True, the field is not so extensive, yet the opportunities for improvements are decidedly in evidence.

The modern railroad track is expected to and necessarily must carry safely the immense weight of the locomotive with its train of heavily loaded cars, must be firm enough to withstand the various strains transmitted to it by the different motions of the rapidly moving trains. It must re-act against a downward pressure, must counteract a lateral thrust, now attacking it here, now—with a suddenness that is of itself disastrous—transferring its force to the opposite side. Then the rolling, wave-like motions have to be met and provided for. All these different motions occurring almost simultaneously have to be absorbed, first by the steel rails, then the ties, finally the ballast or roadbed. The more gradual this absorption, the more nearly the locomotive and its train preserve their equilibrium, the less strain is given both the rolling stock and track, and a closer approach is gained to "easy riding" track.

Given the proper weight of rail so as to lend rigidity to the track, sound ties uniformly spread to give an even bearing to the rail, proper quality and depth of ballast to form a suitable cushion, good drainage to counteract the effect of moisture, the remaining factors are good line and surface, which should be maintained without the traveling public knowing there is any work going on, renewal of ties and surfacing should not be noticeable when riding over track. Work should be so arranged and performed that renewals and surfacing work will go on simultaneously without temporarily breaking up the surface of the track.

THE ROAD BED

The most important requirement in maintaining good track surface and line is thorough drainage, without which all efforts to hold first-class line and surface are wasted. Where proper drainage is provided the desired results can be more readily and easily obtained and the surface and line can be more economically maintained and preserved.

The roadbed should be so built up that the shoulders will be wide enough to permit of the proper sloping of the ballast and prevent the same from rolling down the embankment or into the ditch. On the other hand the shoulders should be low enough to permit the free drainage of the ballast, that is, the shoulder should be a trifle lower than the sub-grade itself so the ballast will drain itself freely.

Ditches deep enough to simply drain the ballast are better than none at all, but they will not aid materially in maintaining good surface. All ditches should be deep enough to properly drain the sub-grade. The bottom of the ditches should be from 2 ft. to 3 ft. below the bottom of the tie, depending upon the nature of the soil. Such a ditch if properly constructed will keep the roadbed fairly well drained and aid materially in maintaining the surface, and in addition will reduce to a considerable extent the liability of track heaving during the winter months.

On double track sections, the ballast, unless very porous, should be dressed off to form an even, shallow gutter between the tracks. From this gutter small cross drains should be run to the side ditches, the object being to carry the water off as rapidly as possible and prevent as much as possible the softening of the roadbed and consequent damage to the surface of the track. Much water can in this way be disposed of which would otherwise be left to soak into the roadbed.

Particular attention must be paid to the drainage of frogs and switches, at railroad crossings, and also at street and highway crossings; the remedy depending on the local conditions. The whole resolves itself, however, into the matter of providing sufficient rapid drainage, which can be accomplished by providing good surface drainage and supplementing it by sub-surfacing wherever necessary.

Railroad crossing should whenever possible be thoroughly drained by using a good depth of cobbles or broken stone, covering the same with ordinary ballast and putting in drains to carry off the water from the bottom of the pit. Always providing sufficient surface drainage in addition, so that all water excepting what actually falls on the crossing will be at once carried away.

Poor drainage of street and highway crossings always breed low joints and many roads having good track everywhere else suffer from this difficulty and each successive rain produces its bad joints at these points. As a rule these points are not only the most expensive ones to maintain, but they are also generally the last ones to receive attention; thus they become a constant source of annoyance. Blind drains of cobbles or broken stone or tiles laid parallel to the track, a little below and beyond the ends of the ties leading to a proper outlet, will carry off the surplus water and avoid the puddling of the joints and save considerable work and money.

At the ends of bridges proper retaining walls or bulk heads of timbers should be provided so the roadbed will not slough off and ballast roll down the embankment, thus cause settling of the track. Track otherwise in fair condition will often show this defect very plainly, and a low place in the track at the end of a

*Read before the Roadmasters' and Maintenance of Way Association, at the twenty-third annual convention, Niagara Falls, N. Y., Sept. 12-14, 1905.

bridge will give a train a very bad jolt. These places must have careful attention and be kept up to the level of the bridge.

GOOD RIDING TRACK

The essentials are, perfect line, correct gage, true level and even surface. The lack of any one, or several of these requirements will produce but indifferent track. It is necessary therefore to correctly gage the rails of the track. To raise the rails to even surface throughout their entire length. To properly level the track. To see the tamping is thoroughly done, so the surface will hold. Then get the track in perfect line, after which the ballast should be filled in and neatly dressed off so that it will readily shed the water and have a tidy appearance.

Lining.—If the track is badly out of line it had better be given a general lining before attempting to do any surfacing. All short kinks should be lined out. All short swings should likewise be attended to. Long, easy swings, although they may be unsightly, will detract very little from the riding merits of the track, as they will produce a little added friction to the rolling stock, but they are a constant reproach to the official and food for criticism to the public. Swings of this kind may be made less noticeable by running them out at the summit of a grade, or by adjusting them so as to be absorbed by a regular curve.

Gaging.—Track that is generally out of gage or wide at joints, should be gaged ahead of the surfacing. At least two men should be sent ahead to do this work, keeping the gaging a day or two ahead of the regular surfacing. One man should nip up the tie with a bar while the other one does the spiking, and each tie must be snugly up to the rail. The track should be so gaged that the gaging tool will just slide down nicely between the rails, neither too loose nor too tight. The gage must be kept uniform throughout and must not be widened through frogs or switches or any other point, unless it be around very sharp curves.

Spiking.—Each tie must be full spiked. All spikes must be set plumb, square to the rail and driven down straight, close to the flange of the rail and snugly down upon the flange. Spikes must not be goose-necked over. Rails must not be brought to gage by drawing the spike, for in doing this the back support of the spike is lost and the space is left for the accumulation of moisture, which of course is detrimental to the tie. If necessary to draw the rail to gage a bar should be used to force the rail to its proper position. Outside spikes of both rails should be on the same side of the tie and the inside spikes should be staggered as much as the face and character of the tie will permit. Ordinarily the spike should be driven two inches from outside of tie. All holes from which spikes have been withdrawn must be plugged; all old spikes that are to be re-driven must be first straightened, no spike that is throat-cut to exceed 1-16 in. should be used again in main track. It is impossible to maintain good gage with such spikes they can be used to better advantage in side track.

Surfacing.—Surfacing should be commenced at one end of the section, preferably at the end farthest from headquarters and should be continued through to the other end, as nothing is gained by skipping around. First thing in the morning a couple of men should be started fastening down spikes, one should nip up the ties with a bar while the other should drive the spikes down thoroughly to the flange of the rail. This is necessary, for if not done, some of the ties will not come up with the rail when the jacks are applied they will hang low and in this way cause uneven surface and imperfectly riding track. All joints should be full bolted and every bolt must be tight.

Track should be surfaced out of face (picking up low joints is not surfacing) the foreman should get back from the jacks as far as he can see well and have a considerable stretch of rail between him and the point where the jack is set. He should sight carefully over the rail on the high side of the track, raising such places as he may find necessary to put rail in good surface. The opposite rail should then be adjusted by the aid of a track level, bringing it up to level if on a tangent or to proper elevation if on a curve.

The track level should be used at every joint at least, the foreman should sight carefully between the points where the track level was used and raise the intermediate points to true surface by eye. It is best not to raise too much track ahead of the general tamping, the tamping should be closed up as much as possible, especially if the gang is small or the traffic is heavy, as passing trains will "knock down" points raised too far ahead which may not be fully tamped upon approach of train.

Economy in this work depends upon the judgment of the foreman in bringing the track to proper surface without unnecessarily disturbing the general level of the track. When not working to grade stakes it is best to work to the high points in the surface, sighting through from one high point to the next. No more track should be disturbed than is absolutely necessary to regain a comparatively even grade, as a constant disturbance of the ties in the bed causes track to settle and such settling will necessarily not be uniform.

Uneven settling of track often occurs for short distances and that is a problem requiring careful attention in order to handle such cases economically and effectively, it may be easier to cut down one or two high points than to raise a number of rail lengths out of face. To know just where to begin on a rail to be raised, to know just where to set the jack to bring the rail to proper surface and to bring a rail to correct surface with a minimum application of the jack are points that are gained only by experience, careful study and thorough application on the part of the foreman.

Light sags are unsightly but do not in any way interfere with the riding quality of the track and unless there is sufficient width of bank and plenty of ballast such sags had better be left. In case of sufficient material and labor,

however, such sags may better be removed and in that case it will be well to have grade stakes set, as it expedites the work.

Tamping properly and thoroughly done is of the utmost importance; each tie should be thoroughly tamped under the rail, from the end of the ties to a distance of about 15 inches inside of the rail. The center of the tie should be tamped just sufficiently to pack the material. Hard tamping in the center of the tie is liable to cause center-bound track, in that case the center of the tie is supported in the nature of a pivot, causing the track to swing from side to side, as the center of gravity of the moving load shifts and the line and surface of the track will soon be ruined. The only remedy for this condition is to raise the track out of face, say half an inch, and then great care must be used to tamp only the ends of the ties, as above suggested.

Regular surfacing should be done by the section gang, as there is a possibility of training these men to tamp alike. Extra gangs nearly always perform this work in an indifferent manner, as the very nature of an extra gang makes it impossible to get uniform results. All the men must be taught how and made to tamp alike; foremen must insist upon this and teach their men how to do the work properly for it is of the utmost importance that all ties be tamped systematically and a uniformity should be maintained in the tamping of each. If one tie is tamped less thoroughly than another, there is certain to be swinging track and bad surface will rapidly develop. The men handling the track jacks should be taught to set them plumb when raising track, so as to avoid throwing the track out of line.

Lining of track should not be undertaken during the heat of the day, generally lining can be done best during the early morning, or possibly in the evening. In connection with the surfacing the lining should be done every evening, the ballast can be roughly filled in after which the piece of track surfaced during the day should be lined. It will generally require about six men with lining bars to do this work. The men should be instructed not to set the lining bars under the rail far enough to get a lifting hold as there will be in that case a tendency to disturb the surface of the track by raising up on it. All kinks and short swings should then be lined out, it will generally be found necessary to rough in the line and then go back over it and put on the finishing touches.

The foreman should preferably have his back to the sun when he is lining track and as far away from his men as he can see well (the tendency being to get too close). When roughing the line the foreman should be five or six rail lengths away from his men, and when finishing up the line he may do good work by keeping three rail lengths away. Foremen should be made to realize that the line of the track is every bit as important as the surface, there is a tendency to spend a considerable time and great care in surfacing and then to hurry up the lining and slight it, this should not be permitted.

Filling in and dressing off the ballast should be attended to every evening after the surfacing and lining has been done. All ballast should be carefully saved and filled in between the ties and dressed off smoothly to present a tidy and finished appearance. The method of dressing the ballast depends upon the kind of material used. The amount of material to be left at the ends of the ties depends entirely upon the nature of the ballast and must be so adjusted that it will admit of free drainage and at the same time help to hold the track in line as much as possible, very porous material will permit the tie to be buried its entire length while other material will have to be sloped towards the ends of the ties to permit free drainage.

Broken stone or slag may be filled in level with the top of the ties, the entire length of the ties if desired and giving it such a slope from the ends of the ties to the grass line as the cross section plan may call for.

Gravel, cinders or sand when used as ballast should be filled in level with the top of the ties (not above them) and sloped slightly down towards the rails so that a shovel can be passed through under the rail, leaving ballast about an inch below the base, then the slope should be continued to the grass line, leaving the ends of the ties about half buried.

Burnt clay or natural earth when used as a ballast should be slightly ridged in the center of the track, level with the top of the ties, sloping evenly to the ends of the ties and leaving the ends practically bare so that all the water may readily pass off, care must be taken to leave a good clear space below the rail between the ties, the material should be dressed off as smoothly as possible.

Curves. Transitions or easements should be used on all curves from one degree upward and, where the speed exceeds 60 miles per hour, on all curves from 30 minutes up. Transitions should also be used between curves of different degree in the same way as they are used between tangents and curves. Using any transition curve of the type of the Searles, Crandall, the Holbrook Spiral, of the Cubic Parabola, which may be run in by deflection or offset.

The length of easement or transition should be the same as the distance in which the curve elevation is run out, and since the elevation depends not only on the degree of curvature, but also upon the speed of trains, the transition should also vary in length, dependent upon the degree of curvature and speed of trains. The superelevation of curves should be at zero point of spiral and shall increase to full elevation at end of spiral or beginning of simple curve.

Since the elevation required is a function of, and depends upon the speed of trains, this speed is the first element to be determined. In general as a matter of safety the preference should be given to the fast passenger trains. Ordinarily an elevation of seven inches will not be exceeded, and speed of trains should be regulated to conform to this elevation.

On roads where the freight traffic predominates and passenger trains do not ordinarily exceed a speed of 40 miles per hour an elevation of ¾ in. per degree may be used. Maximum elevation not to exceed 5 inches.

On the ordinary road, handling a mixed traffic and where passenger trains do not exceed a speed of 50 miles per hour, an elevation of 1 inch per degree probably will be a good compromise, maximum elevation not to exceed 5 or 6 inches.

On roads where fast passenger service is a specialty and the speed of such passenger trains ranges from 50 to 75 miles per hour, an elevation of from 1½ in. or 2½ in. per degree may be necessary according to the varying conditions, maximum elevation not exceeding 7 inches.

No set rules can be laid down for the elevation of the outer rail on curves, local conditions, traffic, grades, etc., all have a bearing on the matter, it is a problem to be worked out by the "cut and try" process. The table given herewith may be useful in determining upon the amount of elevation.

Permanent witnesses should be placed at points of tangents, points of spiral, points of simple curve and points of change of curvature, each witness should also indicate the amount of elevation at that point. Center stakes should be maintained on all curves and they should not be more than 25 feet apart on transitions, nor more than 50 feet apart on simple curves. Center stakes should be checked and missing stakes replaced every year if possible.

Bad line is more noticeable on curves than anywhere else, the natural tendency for track on curves to go outward. If the outer rail is not sufficiently elevated, each train passing tends to force it just a little farther out. Then the trackman's unconscious and unconquerable desire is to line the track out, which tendency of course produces a sharp place or elbow at each end of the curve in order to get back to tangent.

If the expansion between the rails has not been rightly proportioned, the track is difficult to keep in line and during hot weather is liable to buckle. Usually the trackman resorts to his old trick and lines out. If the expansion has not been provided for it should be done at once by cutting out sufficient rail and then lining the curve in to center stakes and true line.

It is often difficult to maintain gauge on curves, in such cases it is best to resort to the use of tie plates, the tie plate has for all time supplanted the rail brace, except for use at frogs and guard rails. Tie plates, properly placed and of sufficient weight, will maintain guage under the most severe tests and they do not injure the ties by excessive spiking as is the case with rail braces.

Gauge on curves should not be widened unless proven absolutely necessary, it is not necessary to widen the gauge on curves on account of freight or passenger cars equipped with ordinary 4 or 6 wheel trucks. Gauge on curves, if widened, should be widened to suit the kind of engine in use on the road. Let the curves be widened to accommodate the engines with the longest rigid wheel base and the other engines will take care of themselves.

There is quite a difference of opinion of some of our best authorities in the matter of widening gauge on curves, as to the exact degree when widening shall begin, ranging all the way from 4 to 10 degrees. For general practice we would recommend ¼ in. for every 5 degrees, say on curves from 5 to 10 degrees widen ¼ in., from 10 to 15 degrees widen ½ in., from 15 to 20 degrees widen ¾ in., over 20 degrees widen 1 inch. One inch being the maximum. When it is made a practice to widen gauge on curve, it should not be guess work, each gang should be equipped with special gauge properly adjusted to give the extra width of gauge.

When it is made a practice to widen gauge on curves in main track where switches and frogs are located, due allowance must be made for extra width, when placing the guardrails opposite the frog, that is the space between the main rail and the guardrail must be made as much wider as the width of the gauge has been increased, in order that the flanges on wheels can freely straddle the guards. Whenever possible, correct substantial gauge should be maintained at all main track frogs and gauge should never be widened at such point unless located in a curve where it becomes absolutely necessary to widen the gauge.

DEGREE OF CURVE	ELEVATION OF OUTER RAIL IN INCHES — VELOCITY IN MILES PER HOUR.												
	10	15	20	25	30	35	40	45	50	55	60	65	70
1	0	1-8	1-4	3-8	5-8	3-4	1 1-8	1 3-8	1 5-8	2	2 3-8	2 3-4	3 1-4
2	1-8	3-8	1-2	7-8	1 1-2	1 5-8	2 1-8	2 5-8	3 1-4	4	4 3-4	5 1-2	6 1-2
3	1-4	1-2	3-4	1 1-4	1 3-4	2 3-8	3 1-8	4	4 7-8	6	7	7	7
4	1-4	5-8	1 1-8	1 5-8	2 3-8	3 1-4	4 1-4	5 3-8	7	6 5-8	7		
5	3-8	3-4	1 1-4	2	3	4	5 1-4	6 5-8	7				
6	3-8	1	1 [illegible]-8	2 1 2	3 1-2	4 7-8	6 1-4	7					
7	1-2	1 1-8	1 7-8	2 7-8	4 1-8	5 5-8	7						
8	1-2	1 1-4	2 1-8	3 1-4	4 3-4	6 1-2	7						
9	5-8	1 3-8	2 3-8	3 3-4	5 3-8	7							
10	3-4	1 1-2	2 5-8	4 1-8	5 7-8	7							
11	3-4	1 3-4	2 7-8	4 5-8	6 1-2	7							
12	7-8	1 7-8	3 1-8	4 7-8	7								
13	7-8	2	3 3-8	5 3-8	7								
14	1	2 1-8	3 5-8	5 3-4	7								
15	1	2 1-4	3 7-8	6 1-4	7								
16	1 1-8	2 1-2	4 1-4	6 5-8									
17	1 1-4	2 5-8	4 1-2	7									
18	1 1-4	2 3-4	4 3-4	7									
19	1 3-8	2 7-8	5	7									
20	1 3-8	3 1-8	5 1-4	7									

E. A. THEED, Chairman.
EDWARD GRAY.
J. CULLOM.
T. HICKEY.
M. SWEENY.
J. O'LEARY.

Committee.

Personals

Mr. James H. McRoberts has resigned as consulting engineer of the West Belt.

Mr. J. G. Gwyn has been appointed assistant chief engineer of the Denver & Rio Grande, with headquarters at Denver, Colo.

Mr. E. A. Everett has been appointed acting signal engineer of the Michigan Central, with headquarters at Detroit.

Mr. C. H. Cannon has been appointed signal engineer of the Louisville & Nashville, with offices at Louisville, Ky.

Edward R. McNeill, division engineer of the Grand Trunk Pacific at Winnipeg, Man., died on October 7th of typhoid fever.

Mr. Charles H. Miller has been appointed engineer of river protection of the Missouri Pacific, with headquarters at St. Louis, Mo.

Mr. A. J. Rossar has been appointed resident engineer of the Canadian Northern in charge of construction work west of Edmonton, Alberta.

Mr. G. U. Ryley, Dominion land surveyor, has been appointed land commissioner of the Grand Trunk Pacific, with headquarters at Montreal, Que.

Mr. Frank T. Darrow has been appointed engineer of maintenance of way of the Nebraska district of the Chicago, Burlington & Quincy, with offices at Lincoln, Neb.

Mr. Charles L. Ruffin, formerly assistant roadmaster of the Richmond, Fredericksburg & Potomac, at Fredericksburg, Va., has been appointed division engineer of the South & Western.

Mr. L. B. Merriam has been appointed resident engineer of the Wyoming division of the Union Pacific at Cheyenne, Wyo., in charge of the double-tracking of the division between Cheyenne and Green River, Wyo.

Mr. Edward Gagel, formerly principal assistant engineer of the New York, New Haven & Hartford, has been appointed chief engineer, with headquarters at New Haven, Conn., succeeding Mr. C. M. Ingersoll.

Mr. C. F. King, formerly foreman of bridges and buildings of the Chicago & Northwestern, has been appointed general roadmaster of the Nebraska & Wyoming division, at Norfolk, Neb.

Mr. J. T. Guiney has been appointed roadmaster of the Southwestern division of the Minneapolis & St. Louis at Estherville, La., in the place of Mr. Con. Lyons, resigned.

Mr. Charles E. Goings has been appointed assistant supervisor of signals of the Philadelphia division of the Pennsylvania railroad at Harrisburg, Pa., vice Mr. W. P. Allen, promoted.

Mr. J. R. C. Renshaw, formerly supervisor of the New York division of the Philadelphia & Reading, has been appointed division engineer of the Harrisburg division, at Harrisburg, Pa.

H. S. Storrs, general superintendent of the Lake Shore & Michigan Southern, died at his home in Cleveland, O., on October 25, from a stroke of paralysis, at the age of 57 years.

Mr. B. J. Dalton has been appointed chief engineer of the Denver, Enid & Gulf, with headquarters at Enid, Okla., effective on November 10, Mr. W. D. Gerber having been assigned to other duties.

It is officially announced that Mr. Russell L. Huntley has been appointed acting chief engineer of the Union Pacific, with offices at Omaha, Neb., vice Mr. J. B. Berry resigned; effective on November 10.

Mr. P. H. Delano has been appointed division engineer of the Cleveland, Cincinnati, Chicago & St. Louis in charge of construction on the Cincinnati division, with headquarters at Middletown, O.

Mr. C. A. Blake, formerly assistant engineer of the Denver & Rio Grande at Springville, Utah, has been appointed division engineer at Salt Lake City, Utah, succeeding Mr. F. E. Baxter, resigned.

Mr. E. E. Turner has been appointed division engineer of the Valley division of the St. Louis, Iron Mountain & Southern at Monroe, La., vice J. T. Denithorne, deceased, effective on November 1.

Mr. Everett E. King, formerly assistant engineer of maintenance of way of the Chicago, Rock Island & Pacific, has been appointed division engineer of the Pacific & Idaho Northern at Weiser, Idaho.

Mr. A. C. Dennis has been appointed division engineer of the Prairie East division of the Grand Trunk Pacific, with headquarters at Winnipeg, Man., effective on November 1, vice E. R. McNeill, deceased.

Mr. W. S. Menden, formerly general superintendent of the West Side Metropolitan Elevated Railway of Chicago, has been appointed chief engineer of the Brooklyn Rapid Transit Railway, with offices at Brooklyn, N. Y.

Mr. J. B. Berry, for a number of years chief engineer of the Union Pacific, has been appointed chief engineer of the Chicago, Rock Island & Pacific, succeeding Mr. W. L. Darling, resigned, effective on November 10.

Mr. L. B. Stillwell, electrical engineer of the Interborough Rapid Transit Company, has been appointed consulting electrical engineer of the New York, Westchester & Boston. Mr. H. S. Putnam has been appointed electrical engineer, with offices at 30 Broad street, New York.

Mr. W. A. Pettis, formerly supervisor of buildings of the Western division of the New York Central & Hudson River will hereafter have entire charge of the buildings along the line from New York to Buffalo with headquarters at New York. Mr. E. Rzkenboer has been appointed acting supervisor of buildings at Rochester in the place of Mr. Pettis.

Mr. Daniel Orr has been appointed inspector of tracks and roadway of the Western Grand division of the Atchison, Topeka & Santa Fe at La Junta, Colo. Mr. T. S. Cafferty has been appointed inspector of track of the Eastern Grand division at Topeka, Kan. Mr. B. A. West has been appointed roadmaster of the Second district at Pueblo, Colo., in the place of Mr. Daniel Orr, and Mr. Frank Lester has been appointed roadmaster of the First and Canyon City district at Pueblo, succeeding Mr. B. A. West.

Mr. Arthur McGuire, formerly assistant engineer of the San Pedro, Los Angeles & Salt Lake, has been appointed chief engineer of the Las Vegas & Tonopah, which has been incorporated recently to build a branch of the first-named road from Las Vegas to Tonopah, Nev. Mr. John Conway, formerly connected with the engineering department of the San Pedro, Los Angeles & Salt Lake, has been appointed superintendent of construction of the Las Vegas & Tonopah.

Mr. M. J. Caples, general manager and chief engineer of the South & Western Railway, Lick Creek & Lake Erie Railway and Carolina Company, announces the following appointments in an official circular dated November 2: Mr. William A. Hankins, principal locating engineer, with offices at Bristol, Tenn., effective on September 1; Mr. A. W. Jones, division engineer, First division, Elkhorn, Ky., to Fink, Va., with offices at Fink, Va., effective on September 25; Mr. William Palmer division engineer, Second division, from Fink, Va., to North Fork of the Holston river, with offices at Clinchport, Va., effective on September 25; Mr. Ward Crosby, division engineer, Third division, North Fork of Holston river to Erwin, Tenn., with offices at Lovedale, Tenn. effective on October 8; Mr. Charles L. Ruffin, division engineer, Fourth division, from Erwin to Spruce Pine with offices at Erwin, Tenn., effective on November 1; Mr. C. O. Vandevanter, division engineer, Fifth division, Spruce Pine to Catawba River, with offices at Spruce Pine, N. C., effective on September 22; Mr. S. P Daniel, division engineer, Sixth division, from Catawba River to Spartansburg, S. C., with offices at Rutherfordton, N. C., effective on October 26.

The Anderson Altitude Valve

The troubles encountered in railroad water service is too well known to descant on here. How to overcome some of them is always in order, though, and that is the purpose of the device shown in our illustration. The automatic and infallible regulation of the height of water in a water station tank is one of those things that works out nicely on paper, but brings grief when zero temperatures prevail—generally. The Golden-Anderson Valve Company of Pitsburg provides for a constant water level under all circumstances by means of a valve that has within itself all of the elements necessary to produce the action required. This valve is shown in section in Fig. 1, and operates automatically in the fullest sense of that abused term. On starting the pump, the bottom valve which in unbalanced is raised from its seat and water passes through to the tank. When the tank is filled to the desired level, the water passes down through a small pipe to the upper part of the valve. The pressure from this column of water raises the upper diphragm of the valve, and the auxiliary stem Q, which action also raises the weighted lever and relieves the small release valve seen in the top of the valve cover. The raising of this valve permits the tank pressure to act on the lower diaphragm which closes with sufficient pressure, and also closes the bottom or main valve and prevents the passage of water to the tank as long as the level remains at its maximum. It is one of the simplest things we have seen for the purpose. Fig. 2 shows the method of installation, in which it is seen that the altitude valve is placed below the water tank in a pit low enough to avoid the frost.

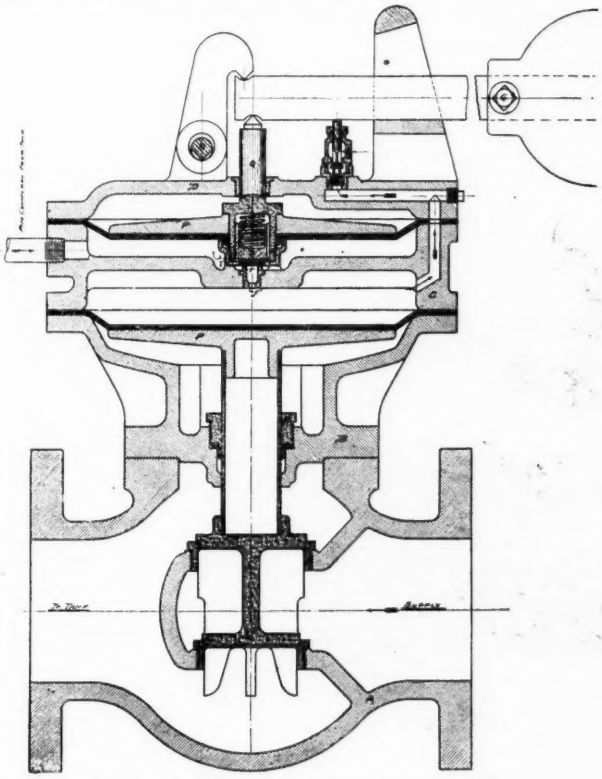


FIG. 1. SECTION OF ANDERSON ALTITUDE VALVE.

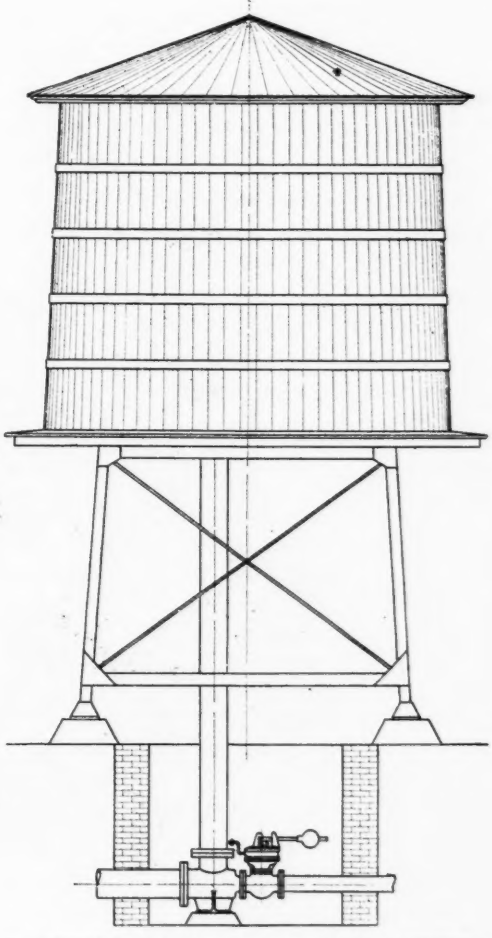


FIG. 2. METHOD OF INSTALLATION OF ANDERSON ALTITUDE VALVE.

The New Mundy Hoisting Engine

Our illustration of the Mundy hoisting engine shows the latest type of this well-known machine, with an engine that is entirely new in design, and having all improvements in details that make for the best results in service, when combined, as in this case, with the proper proportions to insure against any possibility of failure under the kind of usage those machines generally get.

The machine is comprised of a standard double friction drum engine which is equipped with the Wright patent single reversing derrick swinging attachment. The peculiar construction of this swinging attachment is such that it takes up very little room, and it is the most efficient device yet perfected for the purpose. The drum is provided with a friction cone head at each end, working between two rotating friction gears which run in opposite directions.

The derrick swinging drum is manipulated entirely by one operating lever, which throws the drum into engagement with either of the friction gears, and when disengaged from the friction gears, the drum remains at rest. All of the gearing for the derrick swinging apparatus is made of cast steel, and the construction is such that this arrangement will swing any derrick under all reasonable conditions. J. S. Mundy, Newark, N. J., is the pioneer designer and builder of the friction drum hoisting engine, of which type of machine our half-tone represents the newest development.

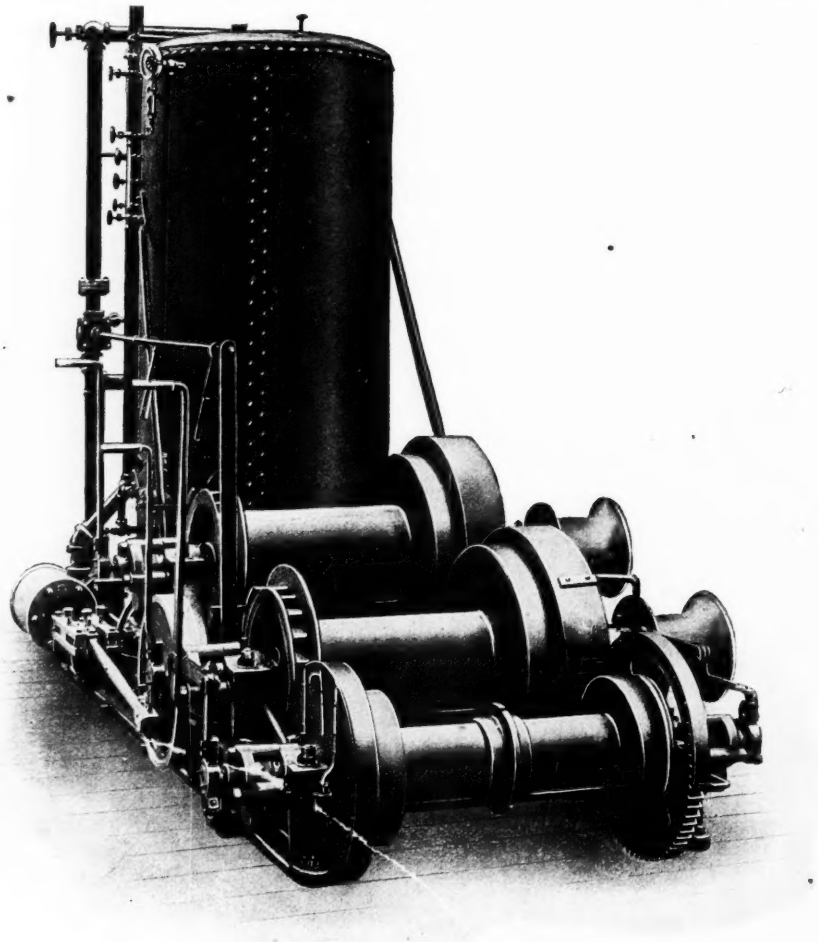
The Ellis System of Pipe Cutters

The word "pipe-cutter" is used as an elastic term to cover a number of mechanical devices for the cutting of pipes. Until recently, pipe-cutters were used only to cut small sizes of wrought iron pipes. It was always taken for granted that it was impracticable or impossible to use a cutter that would cut off any or all kinds and sizes of pipe. This is the reason why large cast iron pipes are being cut by means of a cold chisel and sledge hammer, when the job could be done much faster and better by the use of the cutter illustrated herewith.

This cutter consists of a frame containing a screw operated yoke, which provides a means of tightening the series of links carrying the cutter wheels. The frame is also provided with two cutting wheels which come in contact with the pipe, whereby all pivotal lost motion is prevented. The series of links carry cutter wheels, proportioned in circumference according to the circumference of the various sized pipes. The links are interchangeable and detachably connected to each other, and the ends of the tightening yoke by means of thumb bolts and nuts, which insures it being changed from one size to any other within the range of the cutter with no other tools than the hands of the operator.

In order to operate the Ellis cutter, it is placed in position as shown in Fig. 1, and an oscillating motion is imparted to the handle, which also serves to tighten up the links carrying the cutter wheels. By referring to the illustrations, it is seen that it is necessary to move the handle only through a small space to make the wheels cover the entire circumference of the pipe.

In cutting a pipe in a trench all the room necessary is enough to pass the links carrying the cutter wheels underneath the pipe. This feature will be appreciated when the work has to be done in a hard rock trench. In making ordinary repairs or inserting specials, the work can be completed with the aid of the cutter



MUNDY HOISTING ENGINE

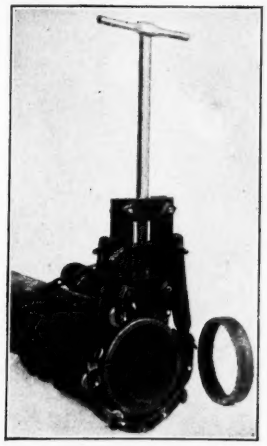


FIG. 1. THE ELLIS PIPE CUTTER IN OPERATION.

FIG. 2. THE ELLIS PIPE CUTTER.

while a hole is being dug out large enough to make a cut with the hammer and chisel, besides the cuts are smooth and clean without any danger of breaking the pipe.

These cutters are manufactured by the Ellis-Ford Pipe Cutter Co., of Detroit, Mich.

Notes of the Month

The West Shore road is to be equipped with the Hall automatic normal danger block signal between Haverstraw and Cornwall, taking in twenty miles of road.

The Air Line division of the New York, New Haven & Hartford is to be double-tracked, shortening the distance twenty-two miles. When this work is completed, a four-hour service will be established between New York and Boston.

The Simplon tunnel is rapidly nearing completion. All masonry work will be finished by December 1st, when track-laying will be begun and rushed through for the opening, which is scheduled for April 1st, on which occasion the inaugural ceremonies of the Milan International Exposition takes place.

In Canada, new railroad construction will cause previous records for such work in that country to look small in comparison. It is estimated that no less than 4,000 miles of road will be built and in operation inside of three years, at a cost of $182,000,000, which figure does not embrace the cost of electric lines projected.

Announcement was made that the Missouri, Kansas & Texas Railway Company will build a line from Oklahoma City to Denver, work to begin in February after the terminals in Kansas City have been finished. It is reported that F. W. Fratt, who is superintending the construction of the terminals, will be chief engineer of the new line.

The Central Railroad of New Jersey has under consideration a reduction of mileage between New York city and Lakewood, by the extension of the branch from Freehold, N. J., which will cut down the distance by way of Redbank, eight miles. This arrangement when consummated will furnish a large passenger travel with express service.

A commentary on the unpreparedness of those in authority in Panama to prosecute the work in hand, is noted in the inability of the Panama Railroad to handle the traffic presented. The rolling equipment is said to be sadly inadequate to handle the freight business, and is hardly sufficient to satisfy the needs of the road for delivery of construction material on the new canal.

In our article descriptive of the Daly track spike, which appeared in our October issue, the address of the manufacturers and also of the Frost Railway Supply Co., was omitted by one of those oversights always attending a rush, even in the best managed organizations. The spike is manufactured by the Daly Spike Co., Detroit, Mich., and it is almost superfluous to say that the location of the Frost Railway Supply Co., known of all men, is also in the same city.

A unique form of signal is sent out by the Buda Foundry & Manufacturing Co., Chicago, in the shape of a folder. This is so arranged that when the folder is opened a red signal arm is raised to danger position. This is as positive in going to danger position by opening the folder as their switch stands are when the switch is opened. The hand and push cars, track drills, jacks, car replacers, frogs, crossings, switches, etc., which they manufacture are all of the same positive action.

The avidity with which steam lines absorb paying electric transportation properties is again demonstrated by the purchase of the United Traction Co. of Albany, which controlled the street car system of Albany, Troy, Rensselaer and Cohoes, the Delaware & Hudson Co. being the purchaser. This move is in consonance with the policy of lines having a commuter or short-haul passenger traffic to come into their own again, and wield the knife that cuts deeply into their dividends through their inability to cope with the electric service.

The advisability of constructing an interlocking switch plant and tower at the crossing of the Santa Fe and the Union Pacific in North Topeka is being seriously considered by officials of those two roads. If it is built it will probably be one of twenty-eight levers. It will make the third one in Topeka, the other two being at the crossing of the Santa Fe with the Missouri Pacific and at the crossing of the Santa Fe main line with its own switching tracks in the yards at Third and Adams streets.

The Long Island road is installing a telephone system for the use of officials of the road when the electrification of the line now under way is completed. It is the intention to put these instruments along about fifty miles of the road at present. Besides this modern idea of handling business, there will be an inspection system inaugurated, by which four men will constitute an emergency crew whose duty it shall be to patrol the line on gasolene motor cars. Instructions to this crew from headquarters will be by means of the new telephone system.

Col. Clarence R. Edwards in charge of the Washington office of the Panama Canal Commission, sought from Secretary Drake of the Panama Railroad Company some information relative to the price of steel rails upon which it developed that the railroad could purchase rails at less than $28 per ton only after the Steel Trust were satisfied that the rails were for use outside of the United States. Mr. Drake gave the further information that the uniform price for steel rails in the United States for the past year had been $28 per ton, against the foreign market price of but $24 per ton. Actual figures for these transactions, it seems, are difficult of access, the prices for export being varied through arrangement between purchaser and manufacturer, with no record to come up and make either party to the transaction afraid.

One of the largest jobs of made terminal yards yet attempted will be those of the Central Railroad of New Jersey at Jersey City, in the Communipaw district, which will embrace an area of more than a mile square, situated south of the present yards and next to the bay, at about tide level. It is estimated that eighteen months will be required to make the fill and bring the surface to the proper condition for service The improvements contemplate a new pier 1,100 feet long, besides several smaller piers and coal trestles and a twenty-stall roundhouse, which will supplement that so long located at Fiddlers, at the western

limit of the old yard. Permission was given the road by the Government for this work only recently, and the work, which is estimated to cost $1,500,000, was immediately started and is to be pressed to completion as rapidly as possible.

Consul-General Mason, recently transferred from Berlin to Paris, sends the following, which appears in a recent consular report: "As a result of existing conditions in France, which affect the relations between capital and the lower grades of labor, there would appear to be a definite demand for the most improved and effectual machinery for excavating and loading earth upon cars or carts in railway or other surface excavations. If the manufacturer of 'Park's automatic loader,' which is understood to be a typical machine of this class, will send his name and address, with the price of his machine and the conditions of delivery, to the American consulate-general in Paris, he will be placed in relations with parties who desire to make an immediate purchase of several machines and give them a highly favorable introduction into this country." And still so many concerns question the advisability of advertising.

The German technical press is devoting some space to the new railway station now under construction at Leipzig, which is said to be the largest structure of the kind in the world, considering area covered, which is 950,518 square feet, and taking in twenty-six tracks. The greatest trackage at this time is at the St. Louis Union Station, numbering thirty-two tracks. The South Station at Boston has twenty-eight tracks, and following these on foreign roads are the St. Lazare station at Paris, and those at Frankfort-on-the-Main, Dresden, Cologne and Munich. The union station now building at Washington is well to the front with these monster terminals with its thirty-three tracks, but these will not be covered with a continuous roof as at Leipzig, the old form of construction giving way to the new idea of umbrella sheds at each track, as in the case of the new Lackawanna terminal now under construction at Hoboken, and which have been recently put in service on the New York Central at Buffalo.

Of the 153 miles of second track which the Santa Fe railroad has undertaken to build this year, seventy-seven miles are now in actual service, according to the statement made by General Superintendent F. C. Fox. A considerable amount more of the track has been completed and is only awaiting ballasting or other minor work before being put into use. "The weather that we are having now could not be beaten so far as helping along the work of construction," he said. "This is the best time of the year we have. If present conditions continue for another three weeks we will have fifty miles more of second track ready to go into servcie. We are working all the men we can." Of the seventy-seven miles of track now in service, the largest amount is on the Illinois division. There are thirty-five miles there. All the work to be done for this year in that state is now completed. On the Missouri division, Mr. Fox states, there are seven miles of new track being used. Twenty-four miles of track are being used on the Eastern division that has been built this year. This is all on the Emporia-Holliday cut-off. There are eleven miles more on the Middle division west of Emporia.

The Pennsylvania road has awarded the sum of $5,000 to its track organization for line and surface work and for improvements in track. For best line and surface between Pittsburg and Jersey City and Washington and Philadelphia Supervisor C. N. Wisman, of Division C, received $800, and assistant supervisor, L. J. Fairbank, $400. On each of the superintendents' divisions for best line and surface, Supervisor J. C. Gucker, of Division No. 3, $600, and John Atlee, assistant supervisor, $200. Supervisor J. W. Swenson, of Division No. 7, $600, and to Assistant Supervisor C. A. Pfalzgraff $200. To George Ehrinfeld, supervisor of Division No. 10, $600, and Assistant Supervisor C. N. Rickey, $200. J. S. Elliott, supervisor of Division No. 3, $600, and to Assistant M. Lipman, $200. The premiums awarded supervisors responsible for the most notable improvements in track up-keep went to H. S. Meiley, Division No. 4, $700, and $300 to Assistant A. E. Preble, besides a premium of $100 to Yard Supervisor W. T. Covert, of Division No. 1. These awards are the result of the annual inspection made by the general manager and chief engineer of the system.

When the large Union Station at the Washington terminal of the Pennsylvania Railroad is completed, it will be one of the finest and best equipped railroad stations in the world, serving all incoming and outgoing trains at Washington. In conformity with the rest of the station the power plant will be equipped with the most up-to-date and best machinery obtainable, steam turbines being selected as prime movers partially on account of the limited amount of space devoted to that purpose. Four 500 kw. steam turbines have been ordered from The Westinghouse Machine Company, of East Pittsburg, Pa., adapted for driving alternating current 60 cycle generators running at 3,600 r. p. m. Dry saturated steam will be used at 150 pounds pressure and 25 inch vacuum, and the turbines will be capable of developing 670 electrical horse power each. The alternating current generators will be of the turbo rotating field type with two poles and a frequency of 7,200 alterations per minute at a normal speed of 3,600 r. p. m. They will deliver three-phase current at 2,300 volts, and, being of the enclosed type, will operate practically without noise.

By the plans now maturing and soon to be in tangible shape, the Baltimore & Ohio is to have a short line between Philadelphia and Chicago, with the object of a quicker schedule for its through service. To do this, a bridge will be built over the Ohio river at Wheeling. There are now two routes to Chicago, one of which is by Pittsburg, and the other Wheeling. The length of the first-named line between Philadelphia and Chicago is 924 miles, and the latter is 951 miles. By the proposed new line the distance is 933 miles, but will have the advantage of a superior roadbed and track over the best and shortest line used at present. The Baltimore & Ohio now crosses the Ohio on the Wheeling Terminal Co.'s bridge, for which privilege a toll is charged for each car. The new million-dollar bridge will connect with the Cleveland, Lorain & Wheeling, which has now a double track its entire length, which, with the new bridge on the line, has made the road one of the most valuable properties of the B. & O. system. The joint loop line around Baltimore, which was projected by the Pennsylvania and Baltimore & Ohio, has been given up as not the thing to solve satisfactorily the needs of the two roads.

The Kansas City Southern Railroad company has definite plans for the expenditure of 5 million dollars in betterments. The expenditure of this money has been decided on and a program is being arranged for carrying out the plans, for putting the road in first-class physical condition and for increasing facilities for the handling of business. There is to be a large increase in the equipment, including freight and passenger cars, locomotives, etc. Recently it was decided that eighty-five pound steel rails should be the standard rail for the Southern. This means that the present rails, including some sixty-five and seventy pound steel, is to be replaced by eighty-five pound rails. The program for betterments includes a large appropriation for improved facilities for handling traffic not only at Kansas City and Port Arthur, but at numerous other points on the system. Freight houses are to be increased in capacity, more track room provided, facilities for handling passengers increased, and numerous other general improvements made. The company now has 12,500 tons of eighty-five pound rails at various points on the system, and the work of laying the heavier rails is progressing rapidly. Between now and the first of January 130 miles of the system will be relaid with eighty-five pound rails. The bridges along the entire system are to be repaired and wooden bridges are to be replaced by steel or concrete bridges.